

FINAL REPORT

EXECUTIVE SUMMARY

US 60 | US 70 | US 191 Corridor Profile Study

Florence Junction (SR 79 Junction) to Douglas

PREPARED FOR **ADOT** MARCH 2017

ADOT WORK TASK NO.
MPD 029-16

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DT11-013154

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EXECUTIVE SUMMARY

INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study (CPS) of US Route 60|US 70 from State Route (SR) 79 to the US 191 Junction and of US 191 from US 70 to the SR 80 Junction (US 60|US 70|US 191). This study examines key performance measures relative to the US 60|US 70|US 191 corridor, and the results of this performance evaluation are used to identify potential strategic improvements. The intent of the corridor profile program, and of ADOT’s Planning-to-Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network.

ADOT is conducting eleven corridor profile studies within three separate groupings. The US 60|US 70|US 191 corridor, depicted in **Figure ES-1**, is one of the strategic statewide corridors identified and the subject of this CPS.

Corridor Study Purpose, Goals and Objectives

The purpose of the CPS is to measure corridor performance to inform the development of strategic solutions that are cost-effective and account for potential risks. This purpose can be accomplished by following the process described below:

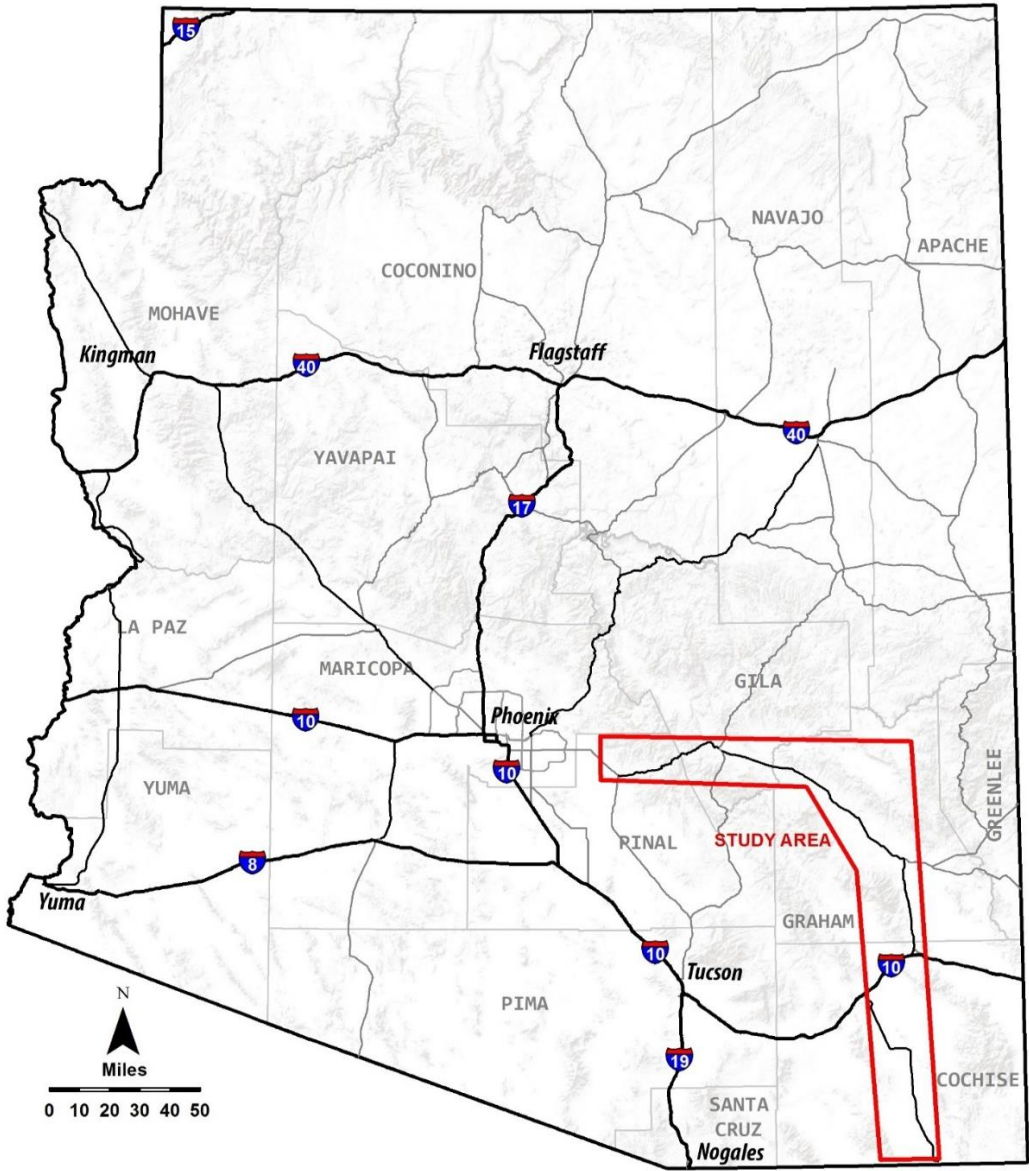
- Inventory past improvement recommendations
- Define corridor goals and objectives
- Assess existing performance based on quantifiable performance measures
- Propose various solutions to improve corridor performance
- Identify specific solutions that can provide quantifiable benefits relative to the performance measures
- Prioritize solutions for future implementation

The objective of the US 60|US 70|US 191 CPS is to identify a recommended set of prioritized potential solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The US 60|US 70|US 191 CPS defines solutions and improvements for the corridor that are evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance.

The following goals are identified as the outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Develop solutions that address identified corridor needs based on measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

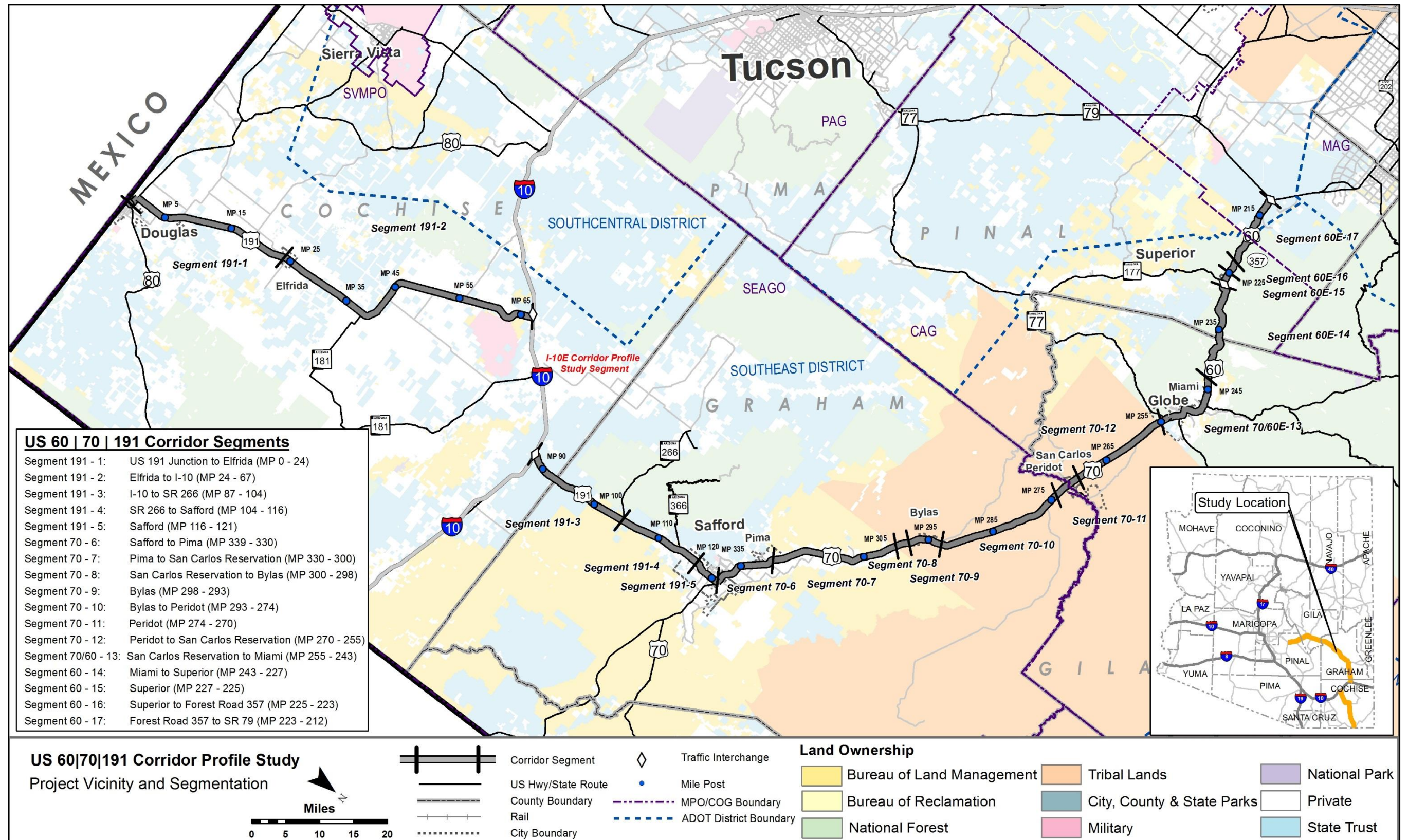
Figure ES-1: Corridor Study Area



Study Location and Corridor Segments

The US 60|US 70|US 191 CPS divides the corridor into seventeen planning segments to facilitate analysis and evaluation. The corridor is segmented at logical breaks where the context changes due to differences in characteristics such as terrain, daily traffic volumes, or roadway typical sections. Corridor segments are shown in **Figure ES-2**.

Figure ES-2: Corridor Location and Segments



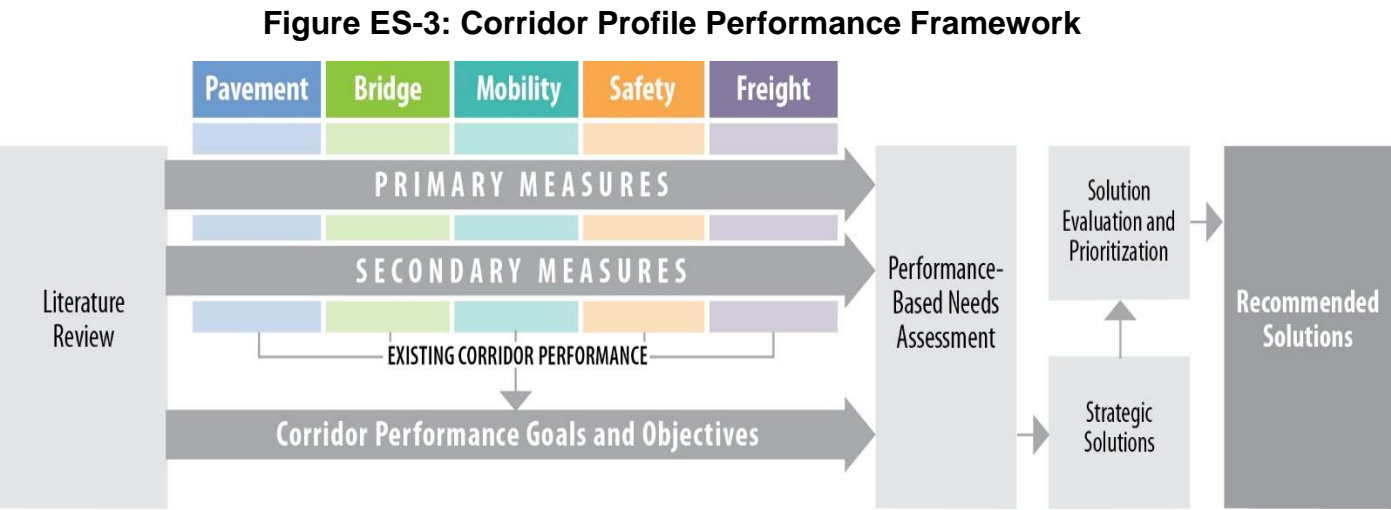
CORRIDOR PERFORMANCE

A series of performance measures are used to assess the US 60|US 70|US 191 corridor. The results of the performance evaluation are used to define corridor needs relative to the long-term goals and objectives for the corridor.

Corridor Performance Framework

This study uses a performance-based process to define baseline corridor performance, diagnose corridor needs, develop corridor solutions, and prioritize strategic corridor investments. In support of this objective, a framework for the performance-based process was developed through a collaborative process involving ADOT and the CPS consultant teams.

Figure ES-3 illustrates the performance framework, which includes a two-tiered system of performance measures (primary and secondary) to evaluate baseline performance.



The following five performance areas guide the performance-based corridor analyses:

- Pavement
- Bridge
- Mobility
- Safety
- Freight

The performance measures include five primary measures: Pavement Index, Bridge Index, Mobility Index, Safety Index, and Freight Index. Additionally, a set of secondary performance measures provides for a more detailed analysis of corridor performance. **Table ES-1** provides the complete list of primary and secondary performance measures for each of the five performance areas.

Table ES-1: Corridor Performance Measures

Performance Area	Primary Measure	Secondary Measures
Pavement	Pavement Index Based on a combination of International Roughness Index and cracking	<ul style="list-style-type: none">• Directional Pavement Serviceability• Pavement Failure• Pavement Hot Spots
Bridge	Bridge Index Based on lowest of deck, substructure, superstructure and structural evaluation rating	<ul style="list-style-type: none">• Bridge Sufficiency• Functionally Obsolete Bridges• Bridge Rating• Bridge Hot Spots
Mobility	Mobility Index Based on combination of existing and future daily volume-to-capacity ratios	<ul style="list-style-type: none">• Future Congestion• Peak Congestion• Travel Time Reliability• Multimodal Opportunities
Safety	Safety Index Based on frequency of fatal and incapacitating injury crashes	<ul style="list-style-type: none">• Directional Safety Index• Strategic Highway Safety Plan Emphasis Areas• Crash Unit Types• Safety Hot Spots
Freight	Freight Index Based on bi-directional truck planning time index	<ul style="list-style-type: none">• Recurring Delay• Non-Recurring Delay• Closure Duration• Bridge Vertical Clearance• Bridge Vertical Clearance Hot Spots

Each of the primary and secondary performance measures identified in the table above is comprised of one or more quantifiable indicators. A three-level scale was developed to standardize the performance scale across the five performance areas, with numerical thresholds specific to each performance measure:

Good/Above Average Performance	Rating is above the identified desirable/average range
Fair/Average Performance	Rating is within the identified desirable/average range
Poor/Below Average Performance	Rating is below the identified desirable/average range

The terms “good”, “fair”, and “poor” apply to the Pavement, Bridge, Mobility, and Freight performance measures, which have defined thresholds. The terms “above average”, “average”, and “below average” apply to the Safety performance measures, which have thresholds referenced to statewide averages.

Corridor Performance Summary

Table ES-2 shows a summary of corridor performance for all primary measures and secondary measure indicators for the US 60|US 70|US 191 corridor. A weighted corridor average rating (based on the length of the segment) was calculated for each primary and secondary measure as shown in **Table ES-2**.

The five areas evaluated are split between “good” (41%), “fair” (29%), and “poor” (31%) ratings. The poorest performing segment is 60-14 which rates as “poor” in bridge, safety, & freight, and “fair” in pavement & mobility. The highest performing segments, 191-4, 70-7, 70-8, and 60-17, do not have “poor” performance areas, and 70-8 in the Bylas on the San Carlos Apache Reservation rated the best performance through this segment, which is only two miles in length.

- Pavement Performance:** All of the 214 miles on the US 60|US 70|US 191 corridor rate as “good” or “fair” for the overall Pavement Index. Due to the significant areas of roughness and pavement cracking, 3 of the 9 segments rate poorly for percentage of area in failure.
- Bridge Performance:** A total of 48 bridges were included in the evaluation. Four bridges on US 60 are considered structurally deficient, including Queen Creek Bridge (MP 227.71, No. 406), Waterfall Canyon Bridge (MP 229.50, No. 328), Pinto Creek Bridge (MP 238.25, No. 351), and Pinal Creek Bridge (MP 249.64, No. 266).
- Mobility Performance:** US 60|US 70|US 191 corridor is considered to have two operating environments for evaluating Mobility. These include Urban/Fringe Urban Highway and Rural Highway. Both the current and future capacity is considered “good” with the exception of 60-14 and 60-15, the area between Miami and Superior, which has mountainous terrain.
- Safety Performance:** Safety performance utilizes the three operating environments for analysis that compare fatal and incapacitating injury crashes to other similar routes statewide. The US 60|US 70|US 191 corridor is mixed between “good” and “poor” ratings. Higher than average fatal crashes occurred on Segments 70-9 and 70-12 through 70-14, with an additional five segments having insufficient crash data.
- Freight Performance:** The performance of freight mobility is overall “poor” within the US 60|US 70|US 191 corridor. This is primarily due to the high PTI. Traffic counters do not exist in 9 of the 17 segments, which does not allow for the performance to be measured for TTI and PTI for much of the corridor.

Table ES-2: Corridor Performance Summary by Segment and Performance Measure

Segment #	Segment Length (miles)	Pavement Performance Area				Bridge Performance Area				Mobility Performance Area												
		Pavement Index	Directional PSR		% Area Failure	Bridge Index	Sufficiency Rating	% of Deck Area on Functionally Obsolete Bridges	Lowest Bridge Rating	Mobility Index	Future Daily V/C	Existing Hour V/C		Closure Extent (instances/milepost/year/mile)		Directional TTI (all vehicles)		Directional PTI (all vehicles)		% Bicycle Accommodation	% Non-Single Occupancy Vehicle (SOV) Trips	
			NB/WB	SB/EB								NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB			
191-12*	24	3.64	3.37	3.37	0%	6.00	89.00	0%	6	0.15	0.17	0.12	0.12	0.03	0.01	1.51	1.30	4.79	7.47	66%	12.5%	
191-22*	43	3.06	3.31	3.31	30%	5.37	76.93	0%	5	0.09	0.10	0.07	0.07	0.02	0.00	1.16	1.16	9.83	6.09	100%	16.0%	
191-32^	17	3.93	3.94	4.02	3%	6.02	93.91	0%	5	0.04	0.04	0.03	0.03	0.01	0.00	1.39	1.20	9.51	11.62	49%	9.8%	
191-42^	12	3.28	3.28	3.28	17%	6.00	69.50	0%	6	0.18	0.20	0.14	0.14	0.03	0.03	N/A	N/A	N/A	N/A	96%	9.3%	
191-51*	5	3.28	3.28	3.28	20%	No Bridges				0.33	0.39	0.27	0.28	0.12	0.08	N/A	N/A	N/A	N/A	27%	22.5%	
70-61*	9	3.70	3.44	3.44	10%	6.00	69.10	0%	6	0.53	0.69	0.32	0.32	0.02	0.06	N/A	N/A	N/A	N/A	46%	19.0%	
70-72^	19	3.43	3.35	3.35	5%	5.77	71.59	0%	5	0.18	0.21	0.13	0.13	0.02	0.00	N/A	N/A	N/A	N/A	73%	16.8%	
70-82^	2	3.87	3.78	3.78	0%	6.00	74.00	0%	6	0.12	0.15	0.08	0.08	0.00	0.10	N/A	N/A	N/A	N/A	0%	13.8%	
70-92^	5	3.81	3.80	3.80	0%	No Bridges				0.25	0.29	0.16	0.17	0.00	0.04	N/A	N/A	N/A	N/A	26%	12.2%	
70-102^	19	3.87	3.55	3.55	5%	7.00	80.00	0%	7	0.17	0.19	0.11	0.11	0.09	0.04	N/A	N/A	N/A	N/A	4%	8.9%	
70-112^	4	3.88	3.55	3.55	0%	7.54	82.03	0%	5	0.21	0.26	0.12	0.12	0.10	0.00	N/A	N/A	N/A	N/A	4%	13.7%	
70-122^	15	3.97	3.83	3.83	0%	6.00	63.20	0%	6	0.19	0.23	0.13	0.13	0.04	0.31	N/A	1.10	N/A	1.40	23%	12.1%	
70 60-131*	12	3.65	3.43	3.34	19%	5.17	78.89	49%	4	0.40	0.46	0.29	0.30	0.00	0.12	1.15	1.31	2.72	3.36	54%	17.0%	
60-142^	16	3.43	3.24	3.24	31%	4.56	18.49	0%	4	1.73	2.11	1.22	1.09	0.33	1.57	1.07	1.19	1.47	2.06	49%	15.0%	
60-152^	2	3.21	2.92	2.92	50%	6.00	83.70	57%	6	2.76	3.83	1.28	1.30	0.36	1.17	1.08	1.17	1.67	2.30	95%	13.0%	
60-162^	2	3.32	3.38	3.38	0%	5.00	86.66	0%	5	0.54	0.71	0.28	0.28	0.50	0.00	1.09	1.00	1.91	1.04	87%	9.0%	
60-172^	11	4.30	4.14	4.02	0%	6.42	91.11	0%	5	0.20	0.26	0.11	0.10	0.09	0.05	1.01	1.01	1.16	1.24	96%	10.0%	
Weighted Corridor Average		3.57	3.49	3.49	13%	5.56	72.20	3%	5	0.32	0.39	0.22	0.21	0.06	0.17					61%	14%	
SCALE																						
Performance Level		Non-Interstate				All				Urban ¹ Rural ²				All		Uninterrupted [^] Interrupted [*]					All	
Good / Above Average		> 3.50				< 5%	> 6.5	> 80	< 12%	> 6	≤ 0.71 (Urban) ≤ 0.56 (Rural)				< 0.22		≤ 1.15 ≤ 1.3		≤ 1.3 ≤ 3.0		> 90%	> 17%
Fair / Average		2.9-3.5				5%-20%	5.0 - 6.5	50 - 80	12%-40%	5 - 6	0.71 - 0.89 (Urban) 0.56 - 0.76 (Rural)				0.22 - 0.62		1.15 - 1.33 ≤ 1.3		1.3 - 1.5 3.0 - 6.0		90% - 60%	17% - 11%
Poor / Average		< 2.90				> 20%	< 5.0	< 50	> 40%	< 5	> 0.89 (Urban) > 0.76 (Rural)				≥ 0.62		≥ 1.33 ≥ 2.0		≥ 1.5 ≥ 6.0		< 60%	< 11%

¹ Urban or Fringe Urban Operating Environment

² Rural Operating Environment

[^] Uninterrupted

^{*} Interrupted

Table ES-2: Corridor Performance Summary by Segment and Performance Measure (continued)

Segment #	Segment Length (miles)	Safety Performance Area							Freight Performance Area							
		Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks	% of Fatal + Incapacitating Injury Crashes Involving Motorcycles	% of Segment Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers	Freight Index	Directional TTTI (trucks only)		Directional TPTI (trucks only)		Closure Duration (mins/milepost/closed/year/ mile)		Bridge Vertical Clearance (feet)
			NB/WB	SB/EB						NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	
191-1a*	24	0.44	0.10	0.78	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.10	1.94	1.60	9.11	11.62	6.78	0.61	No UP
191-2a*	43	0.28	0.53	0.03	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.09	1.00	1.54	2.68	19.67	2.41	0.70	22.04
191-3b^	17	1.00	0.00	2.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.08	1.34	1.82	8.92	17.43	2.94	0.00	No UP
191-4a^	12	0.03	0.07	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	3.37	4.02	No UP
191-5c*	5	1.30	1.34	1.25	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	26.32	40.04	No UP
70-6c*	9	0.93	1.68	0.18	73%	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	3.96	16.64	No UP
70-7a^	19	0.10	0.20	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	2.42	0.00	17.03
70-8a^	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	0.00	22.10	No UP
70-9a^	5	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	0.00	15.52	No UP
70-10a^	19	1.88	1.50	2.25	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	21.73	25.56	No UP
70-11a^	4	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	27.45	0.00	No UP
70-12a^	15	1.67	1.67	1.67	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	1.14	N/A	2.01	7.71	127.15	No UP
70 60-13c*	12	2.09	1.64	2.55	57%	Insufficient Data	Insufficient Data	Insufficient Data	0.19	1.24	1.46	4.29	6.19	0.00	19.07	15.84
60-14a^	16	3.23	2.23	4.23	55%	Insufficient Data	Insufficient Data	Insufficient Data	0.43	1.18	1.60	2.34	2.36	68.54	378.72	13.03
60-15a^	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.33	1.13	1.25	1.87	4.23	107.46	249.09	16.79
60-16a^	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.49	1.14	1.00	2.98	1.12	108.80	0.00	No UP
60-17b^	11	0.81	1.28	0.33	42%	Insufficient Data	Insufficient Data	Insufficient Data	0.72	1.07	1.14	1.23	1.54	13.65	19.62	No UP
Weighted Corridor Averages		1.01	0.87	1.15					0.52					13.31	45.89	
SCALE																
Performance Level		2 or 3 Lane Undivided Highway 2, 3 or 4 Lane Divided Highway 4 or 5 Lane Undivided Highway							Uninterrupted Interrupted				All			
Good/Above Average		a	≤ 0.94		< 51.2%	< 5.2%	< 18.5%	< 2.2%	> 0.77	<1.15		< 1.3		< 44.18		> 16.5
		b	≤ 0.77		< 44.4%	< 3.5%	< 16.3%	< 2.4%	> 0.33	< 1.30		≤ 3.0				
		c	≤ 0.80		< 42.4%	< 6.1%	< 6.4%	< 4.7%								
Fair/Average		a	0.94-1.06		51.2% - 57.5%	5.2% - 7.1%	18.5% - 26.5%	2.2%-4.2%	0.67-0.77 0.17-0.33	1.15-1.33 1.30-2.0		1.3-1.5 3.0-6.0		44.18-124.86		16.0-16.5
		b	0.77-1.23		44.4% - 54.4%	3.5% - 7.3%	16.3% - 26.3%	2.4%-4.5%								
		c	0.80-1.20		42.4% - 51.1%	6.1% - 9.6%	6.4% - 9.4%	4.7%-7.9%								
Poor/Below Average		a	≥ 1.06		> 57.5%	> 7.1%	> 26.5%	> 4.2%	< 0.67 <0.17	>1.33 > 2.0		> 1.5 > 6.0		> 124.86		<16.0
		b	≥ 1.23		> 54.4%	> 7.3%	> 26.3%	> 4.5%								
		c	≥ 1.20		> 51.1%	> 9.6%	> 9.4%	> 7.9%								

^a 2 or 3 Lane Undivided

^b 2,3 or 4 Lane Divided

^c 4 or 5 Lane Undivided

[^] Uninterrupted

* Interrupted

*Note: "Insufficient Data" indicates there was not enough data available to generate reliable performance ratings
"No UP" indicates no underpasses are present in the segment*

NEEDS ASSESSMENT

Corridor Description

The US 60|US 70|US 191 corridor links the Mexico border at the City of Douglas and the Phoenix metropolitan area to agricultural, mining and recreational activity in southeastern Arizona. In general, all three highways are two-lane facilities designed for relatively modest traffic volumes in a rural setting. At the same time, the corridor offers some unique benefits within the Arizona circulation system that could be leveraged for increased usage as the need arises.

US 191 provides a link between Mexico and Interstate 10 (I-10), the primary east-west interstate corridor along the southern states. As a result, US 191 serves as a major freight corridor for goods moving between Mexico and the United States. Similarly, the combination of US 191 and US 70 between I-10 and Globe offers a critical connection to mining and agricultural interests located in the greater Safford and Globe areas of Graham and Pinal Counties. US 60 between Globe and SR 79 links activities within the corridor to the major population and commerce center of the Phoenix metropolitan area.

Corridor Objectives

Statewide goals and performance measures were established by the ADOT Long-Range Transportation Plan (LRTP), 2010-2035. Statewide performance goals that are relevant to US 60|US 70|US 191 performance areas were identified and corridor goals were then formulated for each of the five performance areas that aligned with the overall statewide goals established by the LRTP. Based on stakeholder input, corridor goals, corridor objectives, and performance results, three “emphasis areas” were identified for the US 60|US 70|US 191 corridor: Mobility, Safety and Freight.

Taking into account the corridor goals and identified emphasis areas, performance objectives were developed for each quantifiable performance measure that identify the desired level of performance based on the performance scale levels for the overall corridor and for each segment of the corridor. For the performance emphasis areas, the corridor-wide weighted average performance objectives are identified with a higher standard than for the other performance areas.

Achieving corridor and segment performance objectives will help ensure that investments are targeted toward improvements that support the safe and efficient movement of travelers on the corridor. Corridor performance is measured against corridor and segment objectives to determine needs – the gap between observed performance and the performance objectives.

Needs Assessment Process

The performance-based needs assessment evaluates the difference between the baseline performance and the performance objectives for each of the five performance areas used to characterize the health of the corridor: Pavement, Bridge, Mobility, Safety, and Freight. The performance-based needs assessment process is illustrated in **Figure ES-4**.

The needs assessment compares baseline corridor performance with performance objectives to provide a starting point for the identification of performance needs. This mathematical comparison results in an initial need rating of None, Low, Medium, or High for each primary and secondary performance measure. An illustrative example of this process is shown in **Figure ES-5**.

The initial level of need for each segment is refined to account for hot spots and recently completed or under construction projects, resulting in a final level of need for each segment. The final levels of need for each primary and secondary performance measure are combined to produce a weighted final need rating for each segment. A detailed review of available data helps identify contributing factors to the need and if there is a high level of historical investment.

Figure ES-4: Needs Assessment Process

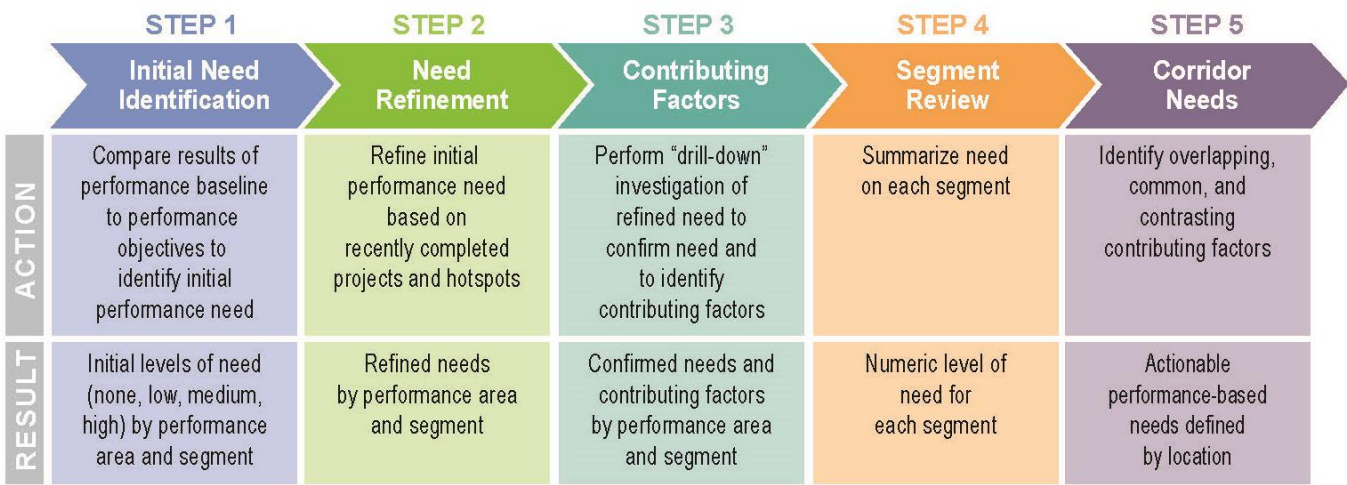


Figure ES-5: Initial Need Ratings in Relation to Baseline Performance (Bridge Example)

Performance Thresholds	Performance Level	Initial Level of Need	Description
6.5	Good	None*	All levels of Good and top 1/3 of Fair (>6.0)
	Good		
	Good		
5.0	Fair	Low	Middle 1/3 of Fair (5.5-6.0)
	Fair		
	Fair	Medium	Lower 1/3 of Fair and top 1/3 of Poor (4.5-5.5)
	Poor		
	Poor	High	Lower 2/3 of Poor (<4.5)
	Poor		

**A segment need rating of ‘None’ does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

Summary of Needs

Table ES-3 provides a summary of needs for each segment across all performance areas, and the average needs for each segment. A weighting factor of 1.5 is applied to the average need scores of the performance areas identified as emphasis areas (mobility, safety, and freight for the US 60|US 70|US 191 corridor). There are 10 segments with a high average need, seven segments with a medium average need, and 31 segments with a low average need. More information on the identified final needs in each performance area is provided below.

Pavement Needs

- Ten segments (60-15, 60-14, 70|60-13, 70-10, 70-7, 70-6, 191-5, 191-4, 191-3, and 191-2) contain pavement hot spots. Most of the hot spots in Segment 191-2 had recent paving projects that addressed the need. Construction for passing lanes in Segment 60-14 will address some of the current pavement issues. The reconstruction project currently underway for Segment 60-15 will address the pavement issues.
- Segments 70|60-13, 70-10, 70-7, 70-6, 191-3, and 191-2 have final needs of low and Segments 191-4 and 191-5 have final needs of Medium. All other segments on the corridor have a final need of None.

Bridge Needs

- Bridge needs were identified on three segments of the corridor, 43 miles (20%) with a “Medium” level of bridge need and 28 miles (13%) with a “High” level of bridge need.
- Eight bridges showed potential repetitive investment issues and may be candidates for life-cycle cost analysis to evaluate alternative solutions.
- Three bridges have bridge ratings of 4: Pinal Creek Bridge (No. 266), Waterfall Canyon Bridge (No. 328), and Queen Creek Bridge (No. 406).
- One bridge had a bridge rating of 5: Pinal Creek Bridge (No. 36).
- Nine bridges were defined as hot spots since they had multiple bridge ratings of 5 or less.
- Of the nine hot spot bridges, five also showed repetitive investment issues. These included the Pinal Creek Bridge (No. 36), Pinal Creek Bridge (No. 266), Pinto Creek Bridge (No. 351), Waterfall Canyon Bridge (No. 328), and Queen Creek Bridge (No. 406).

Mobility Needs

- Mobility Performance is an Emphasis Area for the US 60| US 70| US 191 corridor, giving it a heavier weight in the analysis.
- A low level of mobility need was identified on 168 miles (79%) of the US 60| US 70| US 191 corridor and a Medium level of mobility need was identified on 33 miles (15%) of the corridor.
- Contributing factors include to reduced mobility performance includes:
 - Closures of the roadway due to flooding (US 191 at MP 53 and MP 66),
 - A concentration of short term closures due to incidents/accidents throughout corridor,
 - A significant number of extended duration closures on US 60 from MP 225 – 228,

- Mountainous grades with a lack of climbing lanes on US 60 from MP 227 – 243,
- Limited passing, acceleration and deceleration on rolling terrain on US 70 from MP 255 – 330,
- Rock-fall on US 60 caused repeated incidents of delay and closures between MP 228 – 248,
- Weather related delay and closures on US 60 between MP 224-243 due to snow, ice and impassable conditions,
- Limited bicycle accommodation on much of the corridor, on US 191 from MP 87 – 104 and MP 116 – 121, and US 60/70 from MP 298 – 243.

Safety Needs

- Safety Performance is an Emphasis Area for the US 60| US 70| US 191 corridor, giving it a heavier weight in the analysis.
- A high level of safety need was identified for 67 miles (31%) of the corridor and low level of safety need identified for 37 miles (17%) of the corridor.
- Contributing factors to the safety need include:
 - Fatalities on SB US 191 in the vicinity of MP 91 – 93, which were single vehicle roll over crashes involving high speed.
 - On both US 191 and US 70 in the Safford area, factors included lack of pedestrian lighting and pedestrian facilities, traffic control device reflectivity, intersection geometry, and high traffic volumes.
 - US 70 from Bylas to Peridot, MP 293 – 274, long stretch of rolling terrain with limited passing lanes and rest areas, with safety factors including shoulder conditions and width, traffic control device reflectivity, clear zone slope and obstructions, and intersection geometry.
 - US 60|US 70 from Peridot to Superior, lack of passing and climbing lanes, deceleration lanes, pedestrian facilities, intersection geometry, high traffic volumes in urbanized areas with high volume of trucks and motorcycles from MP 227 - 243
 - US 60|70 from Globe to Superior, MP 227 – 255, high crash rate due to shoulder conditions, shoulder width, high speeds, clear zone slope and obstructions, high traffic volumes.

Freight Needs

- Freight Performance is an Emphasis Area for the US 60| US 70| US 191 corridor, giving it a heavier weight in the analysis.
- A low level of freight needs was identified on 15 miles (7%) of the US 60| US 70| US 191 corridor and a high level of freight need was identified on 116 miles (54%) of the corridor.
- High level of delay related to the Planning Time Index (PTI) contributed to freight needs for NB/SB US 191 MP 0 – 104, EB/WB US 60 MP 225 – 255, and EB US 70 MP 270 – 255.
- The number of closures on US 60| US 70| US 191 due to incidents/accidents or obstructions/hazards are above statewide average in the following areas:

- US 191 MP 0 – 67 including flooding at MP 53 and MP 66
- US 191 MP 43 (Border Patrol Check Point)
- Concentration of short term closures due to incidents/accidents at the following locations:
 - Incidents/accidents US 191 MP 115 – 120
 - US 60 from MP 233 – 242,
 - US 60 from MP 228 – 231.7 (with a high concentration of incidents at MP 230), and
 - US 60 from MP 224 – 227
- Significant number of extended duration closures on US 60 from MP 225 – 228
- Mountainous grades with a lack of passing and climbing lanes on US 60 from MP 227 - 243
- Limited passing, acceleration and deceleration on rolling terrain on US 70 MP 255 - 330
- Rock fall on US 60 caused repeated incidents of delay and closures between MP 228 – 248
- Weather related delay and closures on US 60 between MP 224-243 due to snow, ice and impassable conditions
- Clearance restrictions exist at Pinal SPRR UP MP 253.63 (No. 562, height of 15.84 feet) and Queen Creek Tunnel MP 228.47 (height of 13.03 feet).

Overlapping Needs

Completing projects that address multiple needs presents the opportunity to more effectively improve overall performance. A summary of the overlapping needs that relate to locations with elevated levels of need is provided below.

- Most segments on the corridor have overlapping needs, approximately 205 miles of the 214 miles or 96% of the corridor. The exceptions include Segments 70-8, 70-9 and 60-16. Traffic counters do not exist in Segments 191-4 through 70-11, approximately 75 miles or 35% of the corridor, resulting in insufficient data to calculate needs in the freight performance area for those locations.
- US 191 MP 87 to MP 104 (Segment 191-3) and US 60|70 MP 243 to MP 255 (Segment 70|60-13) have overlapping needs in all five performance areas. These segments comprised 29 of the 214 corridor miles.
- Segment 191-3 has an overall “Medium” need, with some level of need in all performance areas. The greater needs relate to mobility and freight due to high TTI and PTI related to accidents and incidents. A few closures have long durations that impacted the segment need level. Also noteworthy is that this segment is immediately north of I-10 and utilized when traffic is detoured through Safford during I-10 closures.
- Segment 70|60-13 has an overall “High” need and the highest need score in the corridor. Some needs are site specific while others are characteristics of the segment. High bridge needs are related to the Pinal Creek Bridge (No. 36) and Pinal Creek Bridge (No. 266),

which are hot spots due to poor structural ratings and exhibit high repetitive investment. High safety needs are due to the more urbanized area with increased volumes and speeds too fast for conditions. High freight needs are due to TTI and PTI times, as well as the US 60 Pinal SPRR at MP 253.63 had low vertical clearance (15.84 feet).

- Segment 60-14 also registers an overall “Medium” need score on the corridor. This segment has significant grades and subsequently suffers from freight and mobility needs related to delay and incidents/accidents associated with the grade. The segment includes 3 hot spot bridges, all of which have repetitive investment histories. The Queen Creek Tunnel, also located in the segment, affects bridge and freight needs with poor deck ratings and low vertical clearance.

Table ES-3: Summary of Needs by Segment

Performance Area	Segment Number and Mileposts (MP)																
	191-1	191-2	191-3	191-4	191-5	70-6	70-7	70-8	70-9	70-10	70-11	70-12	70 60-13	60-14	60-15	60-16	60-17
	MP 0-24	MP 24-67	MP 87-104	MP 104-116	MP 116-121	MP 339-330	MP 330-300	MP 300-298	MP 298-293	MP 293-274	MP 274-270	MP 270-255	MP 255-243	MP 243-227	MP 227-225	MP 225-223	MP 223-212
Pavement	None*	Low	Low	Medium	Medium	Low	Low	None*	None*	Low	None*	None*	Low	Low	None*	None*	None*
Bridge	None*	Medium	Low	Low	None*	Low	Low	None*	None*	None*	Low	Low	High	High	Low	None*	Low
Mobility+	Low	Low	Medium	None*	Low	Low	Low	Low	Low	Low	Low	Low	Low	Medium	None*	None*	None*
Safety+	None*	None*	Low	None*	High	Low	None*	N/A	N/A	High	N/A	High	High	Medium	N/A	N/A	None*
Freight+	High	High	High	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Low	High	Medium	Low	Low	None*
Average Need	0.92	1.38	1.69	0.60	2.00	1.00	0.70	0.43	0.60	1.40	0.83	1.31	2.23	2.00	0.50	0.30	0.38

*A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as this study.

+ Identified as an emphasis area for the US 60|US 70|US 191 corridor

Average Need Scale	
None*	< 0
Low	0.1-1.0
Medium	1.0-2.0
High	> 2.0

STRATEGIC SOLUTIONS

The principal objective of the CPS is to identify strategic solutions (investments) that are performance-based to ensure that available funding resources are used to maximize the performance of the State’s key transportation corridors. One of the first steps in the development of strategic solutions is to identify areas of elevated levels of need as addressing these needs will have the greatest effect on corridor performance. Segments with Medium or High needs and specific locations of hot spots are considered strategic investment areas for which strategic solutions should be developed. Segments with lower levels of need or without identified hot spots are not considered candidates for strategic investment and are expected to be addressed through other ADOT programming processes. US 60|US 70|US 191 strategic investment areas (resulting from the elevated needs) are shown in **Figure ES-6**.

Screening Process

In some cases, needs that are identified do not advance to solutions development and are screened out from further consideration because they have been or will be addressed through other measures including:

- A project is programmed to address this need
- The need is a result of a Pavement or Bridge hot spot that does not show historical investment issues; these hot spots will likely be addressed through other ADOT programming means
- A bridge is not a hot spot but is located within a segment with a Medium or High level of need; this bridge will likely be addressed through current ADOT bridge maintenance and preservation programming processes.
- The need is determined to be non-actionable (i.e., cannot be addressed through an ADOT project)
- The conditions/characteristics of the location have changed since the performance data was collected that was used to identify the need

Candidate Solutions

For each elevated need within a strategic investment area that is not screened out, a candidate solution is developed to address the identified need. Each candidate solution is assigned to one of the following three P2P investment categories based on the scope of the solution:

- Preservation
- Modernization
- Expansion

Documented performance needs serve as the foundation for developing candidate solutions for corridor preservation, modernization, and expansion. Candidate solutions are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT’s traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the US 60|US 70|US 191 corridor will be considered along with other candidate projects in the ADOT statewide programming process.

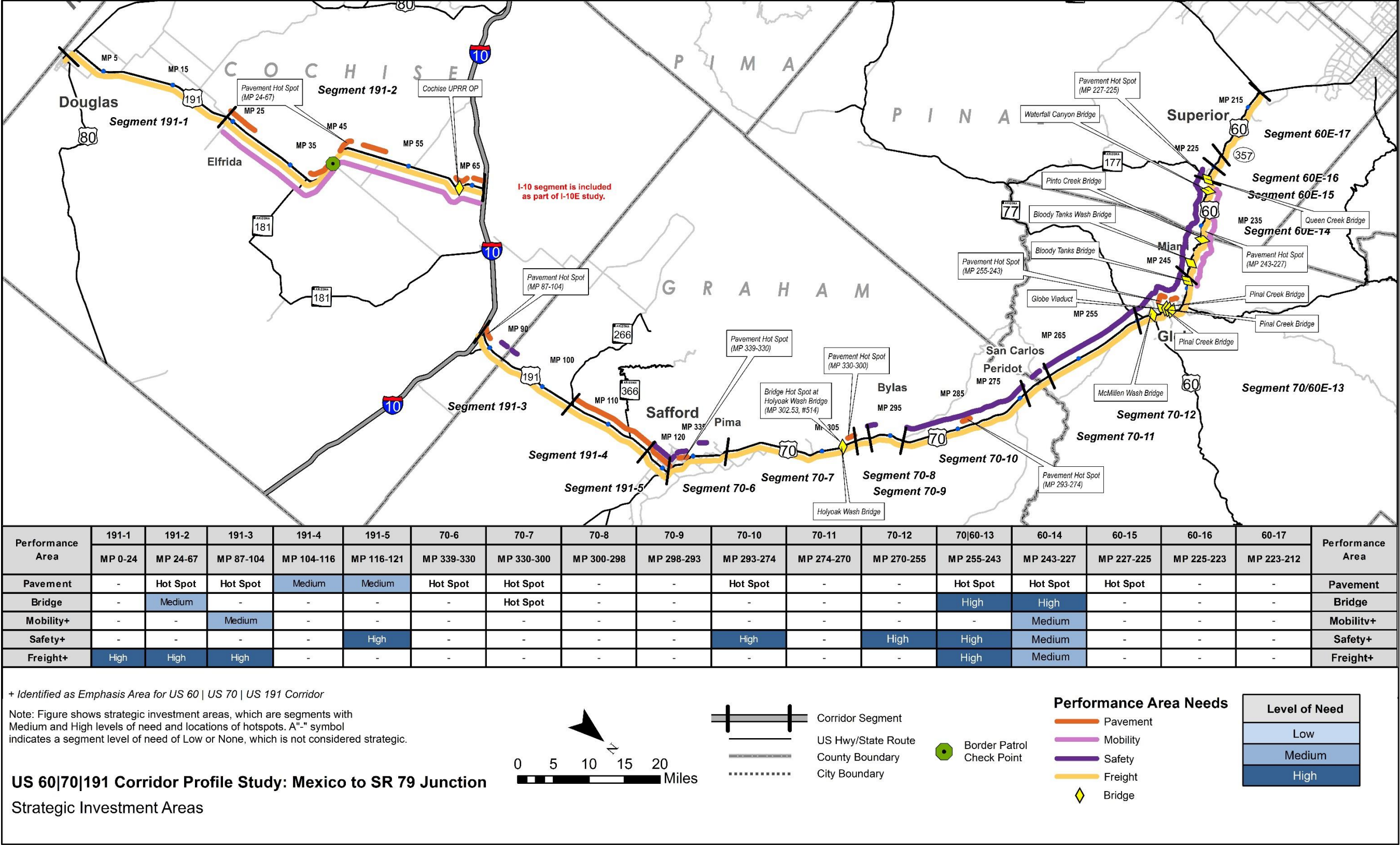
Candidate solutions include some or all of the following characteristics:

- Do not recreate or replace results from normal programming processes
- May include programs or initiatives, areas for further study, and infrastructure projects
- Address elevated levels of need (High or Medium) and hot spots
- Focus on investments in modernization projects (to optimize current infrastructure)
- Address overlapping needs
- Reduce costly repetitive maintenance
- Extend operational life of system and delay expansion
- Leverage programmed projects that can be expanded to address other strategic elements
- Provide measurable benefit

Candidate solutions developed to address an elevated need in the Pavement or Bridge performance areas include two options; rehabilitation or full replacement. These solutions are initially evaluated through a Life-Cycle Cost Analysis (LCCA) to provide insights into the cost-effectiveness of these options so a recommended approach can be identified. Candidate solutions developed to address an elevated need in the Mobility, Safety, or Freight performance areas are advanced directly to the Performance Effectiveness Evaluation. In some cases, there may be multiple solutions identified to address the same area of need.

Candidate solutions that are recommended to expand or modify the scope of an already programmed project are noted and are not advanced to solution evaluation and prioritization. These solutions are directly recommended for programming.

Figure ES-6: Strategic Investment Areas



SOLUTION EVALUATION AND PRIORITIZATION

Candidate solutions are evaluated using the following steps: LCCA (where applicable), Performance Effectiveness Evaluation, Solution Risk Analysis, and Candidate Solution Prioritization. The methodology and approach to this evaluation are shown in **Figure ES-7** and described more fully below.

Life-Cycle Cost Analysis

All Pavement and Bridge candidate solutions have two options: rehabilitation/repair or reconstruction. These options are evaluated through an LCCA to determine the best approach for each location where a Pavement or Bridge solution is recommended. The LCCA eliminates options from further consideration and identify which options should be carried forward for further evaluation.

All Mobility, Safety, and Freight strategic investment areas that result in multiple independent candidate solutions are advanced directly to the Performance Effectiveness Evaluation.

Performance Effectiveness Evaluation

After completing the LCCA process, all remaining candidate solutions are evaluated based on their performance effectiveness. This process includes determining a Performance Effectiveness Score (PES) based on how much each solution impacts the existing performance and needs scores for each segment. This evaluation also includes a Performance Area Risk Analysis to help differentiate between similar solutions based on factors that are not directly addressed in the performance system.

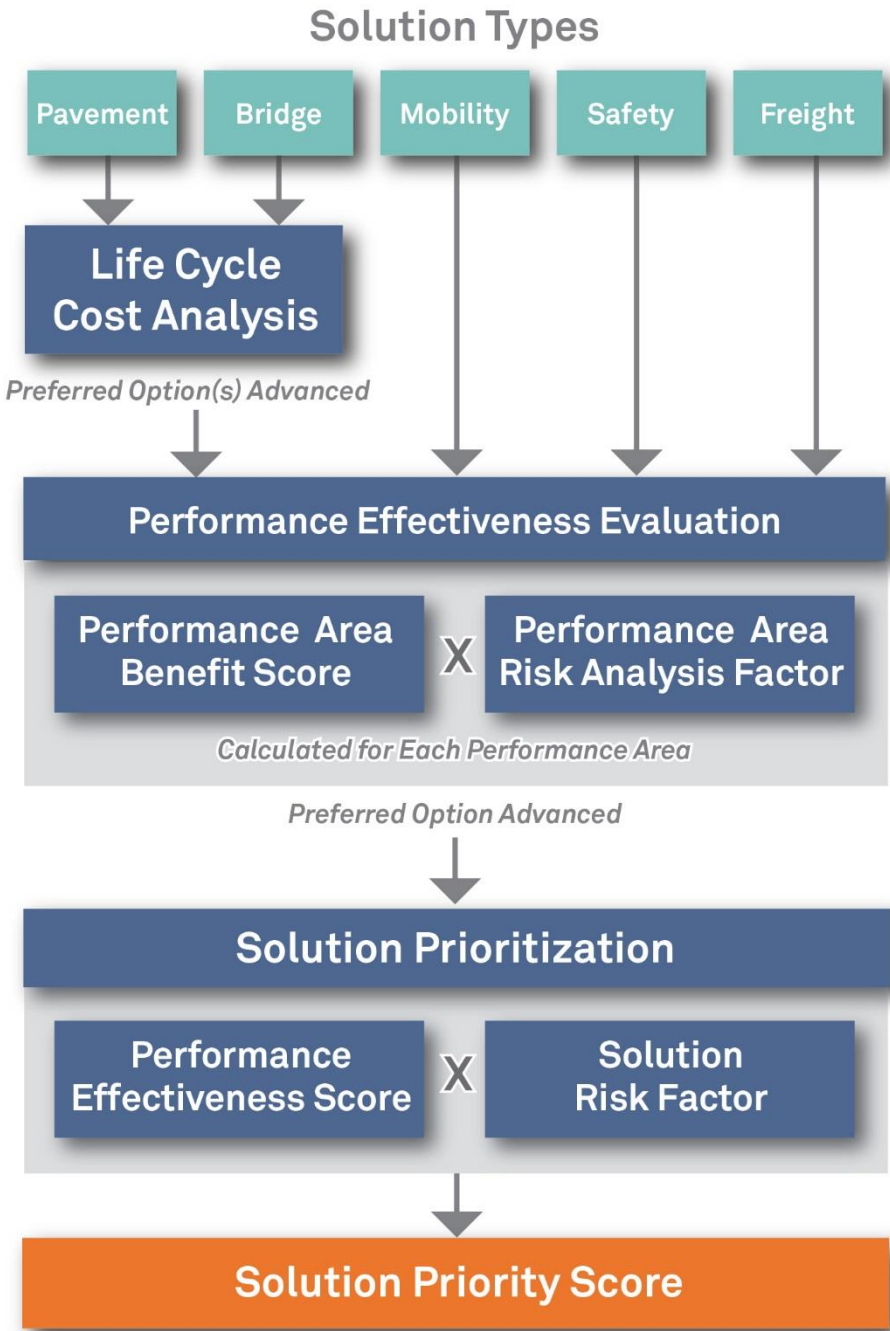
Solution Risk Analysis

All candidate solutions advanced through the Performance Effectiveness Evaluation are also evaluated through a Solution Risk Analysis process. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of the performance failure.

Candidate Solution Prioritization

The PES, weighted risk factor, and segment average need score are combined to create a prioritization score. The candidate solutions are sorted by prioritization score from highest to lowest. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process.

Figure ES-7: Candidate Solution Evaluation Process



SUMMARY OF CORRIDOR RECOMMENDATIONS

Table ES-4 and **Figure ES-8** show the prioritized candidate solutions recommended for the US 60|US70|US 191 corridor. These solutions will increase the performance of the US 60|US70|US 191 corridor primarily in the Freight Performance Area. Solutions that address multiple performance areas tend to score higher in this process. Other findings include:

- Most of the anticipated improvements in performance are in the Mobility, Safety, and Freight performance areas
- The highest ranking solutions tended to have overlapping benefits in the Mobility, Safety, and Freight performance areas
- The highest priority solutions address needs in the US 60 Superior to Miami area

Other Corridor Recommendations

As part of the investigation of strategic investment areas and candidate solutions, other corridor solutions were also identified that are compatible with the long range vision to increase safety and support truck and freight movements:

- Sign Visibility Study in the Safford area along US 191 is recommended to identify locations with potential to improve retroreflectivity
- Road Safety Assessments are recommended in Peridot, Cutter and Globe to identify safety improvements, specifically pedestrian circulation and access needs in Peridot.
- Access Control Studies in Peridot (MP 270 – 274) and Globe-Miami (MP 243 – 255) are recommended to reduce friction and improve safety
- Recommend Superior to Globe Design Concept Study
- Recommend San Carlos Area (MP 268 – 292) Superelevation Study

Policy and Initiative Recommendations

In addition to location-specific needs, general corridor and system-wide needs have also been identified through the CPS process. While these needs are more overarching and cannot be individually evaluated through the CPS process, it is important to document them. A list of recommended policies and initiatives was developed for consideration when programming future projects not only on US 60|US 70|US 191, but across the entire state highway system where conditions are applicable. The following list, which is in no particular order of priority, was derived from the Round 1, Round 2, and Round 3 CPS:

- Install Intelligent Transportation System (ITS) conduit with all new infrastructure projects
- Prepare strategic plans for Closed Circuit Television (CCTV) camera and Road Weather Information System (RWIS) locations statewide
- Leverage power and communication at existing weigh-in-motion (WIM), dynamic messaging signs (DMS), and call box locations to expand ITS applications across the state
- Consider solar power for lighting and ITS where applicable
- Investigate ice formation prediction technology where applicable
- Conduct highway safety manual evaluation for all future programmed projects
- Develop infrastructure maintenance and preservation plans (including schedule and funding) for all pavement and bridge infrastructure replacement or expansion projects

- Develop standardized bridge maintenance procedures so districts can do routine maintenance work
- Review historical ratings and level of previous investment during scoping of pavement and bridge projects; in pavement locations that warrant further investigation, conduct subsurface investigations during project scoping to determine if full replacement is warranted
- For pavement rehabilitation projects, enhance the amount/level of geotechnical investigations to address issues specific to the varying conditions along the project
- Expand programmed and future pavement projects as necessary to include shoulders
- Expand median cable barrier guidelines to account for safety performance
- Install CCTV cameras with all DMS
- In locations with limited communications, use CCTV cameras to provide still images rather than streaming video
- Develop statewide program for pavement replacement
- Install additional continuous permanent count stations along strategic corridors to enhance traffic count data
- When reconstruction or rehabilitation activities will affect existing bridge vertical clearance, the dimension of the new bridge vertical clearance should be a minimum of 16.25 feet where feasible
- All new or reconstructed roadway/shoulder edges adjacent to an unpaved surface should be constructed with a Safety Edge
- Collision data on tribal lands may be incomplete or inconsistent; additional coordination for data on tribal lands is recommended to ensure adequate reflection of safety issues
- Expand data collection devices statewide to measure freight delay
- Evaluate and accommodate potential changes in freight and goods movement trends that may result from improvements and expansions to the state roadway network

Next Steps

Candidate solutions developed for the US 60|US 70|US 191 corridor will be considered along with other candidate projects in the ADOT statewide programming process. It is important to note that the candidate solutions are intended to represent strategic solutions to address existing performance needs related to the Pavement, Bridge, Mobility, Safety, and Freight performance areas. Therefore, the strategic solutions are not intended to preclude recommendations related to the ultimate vision for the corridor that may have been defined in the context of prior planning studies and/or design concept reports. Recommendations from such studies are still relevant to addressing the ultimate corridor objectives.

Upon completion of all three CPS rounds, the results will be incorporated into a summary document comparing all corridors that is expected to provide a performance-based review of statewide needs and candidate solutions.

Table ES-4: Prioritized Recommended Solutions

Rank	Candidate Solution #	Option	Candidate Solution Name	Candidate Solution Scope	Estimated Cost (\$ million)	Investment Category Preservation [P], Modernization [M], Expansion [E]	Prioritization Score
1	60.8	-	US 60 Globe-Miami Safety Improvements	Install lighting Install speed feedback signs (MP 246 - 250) Install warning signs with beacons in advance of SR 188 intersection	\$7.7	M	167
2	60.11	-	US 60 Waterfall Canyon Bridge (#328)	Replace Bridge	\$1.7	M	153
3	191.2	-	US191 Safford Safety Improvements	US 191/Armory Road Intersection: Install Warning Signs with Beacons, Improve Signal Visibility US 191/Discovery Park Intersection: Improve Signal Visibility, Install Dynamic Speed Feedback Signs US 191/Lone Star Intersection: Install Traffic Signal, Install Warning Signs with Beacons US 191/16th Street Intersection: Install Warning Signs with Beacons	\$0.6	M	151
4	60.6	-	US 60 Pinal Creek Bridge (#36)	Replace Bridge	\$2.4	M	109
5	60.12	A	US 60 Top-of-the-World to Superior Widen shoulder	Widen Shoulders (EB MP 227.0 to 227.6, EB MP 227.7 to 228.3, EB MP 228.5 to 232, WB 238.0 to 239.5), Install Rock-Fall Mitigation (WB MP 227.7 to 228, WB MP 233 to 233.3, WB MP 240.2 to 240.4, WB MP 239.5 to 239.45, WB MP 239.6 to 239.75), dynamic weather warning beacons and RWIS. *Note: Queen Creek Tunnel limits omitted from solution (MP 228.3 – 228.5)	\$8.4	M	106
		C	US 60 Top-of-the-World to Superior Construct New 4-lane divided	Construct four-lane divided (using 2 existing-lanes for one direction) (Cost based upon US 60 Superior to Globe Feasibility Study 2014)	\$497.8	E	77
		B	US 60 Top-of-the-World to Superior Climbing/ Passing Lanes	Widen Shoulders (EB MP 227.0 to 227.6, EB MP 227.7 to 228.3, EB MP 228.5 to 232, WB 238.0 to 239.5), Install Rock-Fall Mitigation (WB MP 227.7 to 228, WB MP 233 to 233.3, WB MP 240.2 to 240.4, WB MP 239.5 to 239.45, WB MP 239.6 to 239.75); Install Dynamic Weather Warning Beacons and RWIS	\$66.5	E	73
6	60.14	-	US 60 Queen Creek Safety Improvements	Widen Shoulders; Install Warning Signs, Dynamic Speed Feedback Signs, Centerline Rumble Strip, Guardrail (EB and WB)	\$3.2	M	106
7	60.13	-	US 60 Top-of-the-World Safety Improvements	Install Warning Signs, Dynamic Speed Feedback Signs, High Visibility Edge Line Striping, Centerline Rumble Strip	\$0.2	M	97
8	60.7	-	US 60 Pinal Creek Bridge (#226)	Replace Bridge	\$3.1	M	95
9	60.9	-	US 60 Pinal SPRR UP (No. 0562) Freight Mitigation	Re-profile roadway to achieve 16.5 feet vertical clearance	\$0.6	M	67
10	60.10	-	US 60 Queen Creek Bridge (#406)	Replace Bridge	\$8.8	M	58
11	70.4	-	US 70 San Carlos Safety Improvements	Install Centerline Rumble Strip (MP 268-292), Warning Signs with Beacons (MP 278.5, 280, 292), Warning Signs (MP 269, 273), Dynamic Speed Feedback Signs (MP 268, 273, 278.5, 280, 292); Widen Shoulders (MP 270-292); Formalize Pullouts (WB MP 274.5, EB MP 279, EB MP 289, WB 292); Construct Passing Lane (WB MP 282-288 and EB 262-264)	\$57.7	M	57
12	70.5	-	US 70 Cutter Safety Improvements	Install Lighting and Center Turn Lane	\$3.1	M	16
13	191.1	A	US 191 Elfrida to I-10 Freight Mitigation: Widen shoulders, realign roadway, replace Cochise RR bridge	Realign Roadway, Replace Cochise RR Bridge	\$46.7	M	3
		B	US 191 Elfrida to I-10 Freight Mitigation: Construct passing lanes, realign roadway, replace Cochise RR bridge	Realign Roadway, Construct Passing Lanes (NB and SB), Replace Cochise RR Bridge	\$62.7	M	2

Figure ES-8: Prioritized Recommended Solutions

